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OF THE

Elisha Mitchell Scientific Society

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ORNITHOLOGICAL WORK IN NORTH CAROLINA*

T. GILBERT PEARSON

Our earliest record of an ornithological observation in North Carolina is that of Captain Barlow who in company with his associate, Captain Amadas, visited the coast in 1584. Entering the Sounds by one of the inlets they sailed to Roanoke Island and landed. Evidently they climbed one of the tree-covered dunes girting the east side of the island, for Captain Barlow writes, "Under the bank or hill whereon we stood, we beheld valleys replenished with goodly cedar trees, and having discharged our barquebus shot, such a flock of cranes (the most part white) arose under us, with such a cry redoubled by many echoes, as if an army of men had shouted together." One visiting Roanoke Island today will still see goodly cedar trees but the herons, (which doubtless were the birds to which he referred) are no longer to be found in such numbers. Three hundred and twenty-five years of

*Presidential address before the North Carolina Academy of Science, May 1, 1908.

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man's destructive influences have written their story large among the bird life of that interesting region, and the most northerly breeding colony of herons known to exist in the State is situated on an island in Matamusket Lake 45 miles away in a southwesterly direction. The birds here are so few in number, and their united cries would not equal the lusty shout of a corporal's guard.

Two years after this, viz.: in 1586, Thomas Hariot came to the island and made a list of the birds he found there. Of these he says there were "Turkey cocks and turkey hens, stock doves, partridges, cranes and herons, and in winter great store of swan and geese. Of all sorts of fowl, I have names in the country language, four score and six; of which number, besides those that he named, we have taken, eaten, and have the pictures as they were drawn, with names of the inhabitants; of several strange sorts of water fowl eight, and seventeen kinds more of land fowl, although we have seen and eaten many more which for want of leisure there for the purpose, could not be pictured; and after we are better furnished and stored upon further discovery with their strange beasts, fish, trees, plants and herbs, they shall be published. There are also parrots, falcons, and merlin-hawks, which although with us they be not used for meat, yet for other causes I thought good to mention."

One of the most interesting items in this narration is the reference to "parrots", which establishes the fact without doubt that the Carolina Paroquet at one time inhabited the immediate neighborhood of the coast.

John Lawson, Gentleman, in his History of North Carolina published in London in 1714, devotes fully ten pages to an enumeration of the birds of the state and a dissertation on the habits and activities of some of them. Many of the birds which he found here were new to him, and as he evidently was not a trained ornithologist he failed in many instances to note the difference between them and those species of Europe which to his eye they much resembled. To many of our native birds therefore he gave the names of English species, and his descriptions being meagre we are often left in doubt as to what birds he really had in mind. Thus what he calls "Moorehen" may have been either the Gallinule or

the coot. His "Lay-wing" was perhaps one of the plovers, the golden, black-bellied, Wilsons or piping, or may have been the dowitcher or turnstone.

Among the hawks he speaks of the "Hobbie". I am yet at a loss to understand to what species he referred as all the other small hawks are evidently accounted for under such English titles as Falcon, Merlin, etc.

He made the mistake of regarding the young Bald Eagle as a distinct species and calls it the gray eagle. This error, by the way, was long followed by subsequent observers of North American bird life. Audubon, writing over a hundred years later, tells in much detail about the life history of the gray eagle, in fact he has left us a full page drawing of the magnificent "Bird of Washington", as he calls it. The fact that the young bald eagle does not acquire its white head and tail until after an elapse of three years will account in a measure at least for its mistaken identity.

On the other hand some of Lawson's statements which bear on the face evidences of being perfectly truthful, reveal some valuable information. One of these is his account of the breeding of the black duck in the eastern marshes and another which tells of the common occurrence of the sand hill crane. These are the only two positive records we have of this character within the borders of North Carolina, for so far as known no one else has recorded cranes in the state, and while the black duck is a common winter visitor and has long been suspected of breeding here, we know of no authoritative record of a nest having been found since this account given by Lawson.

In the days of Lawson the wild pigeon which has since become extinct, was an aboundant bird in North Carolina. They probably gathered to breed in vast numbers in the mountains, after which they spread over the low country and their numbers being augmented by great flights from the north, the pigeon population must have been something enormous. Lawson says "I saw such prodigious flocks of these pigeons in January and February, 1701-2 (which were in the hilly country between the great nation of the Esaw Indians and the pleasant stream of Sapona, which is the west branch of Clarendon, or Cape Fear River, that

they had broke down the limbs of a great many large trees all over those woods, whereon they chanced to sit and roost; especially the great pines which are more brittle wood, than our sots of Oak are. These Pigeons, about sunrise, when we were preparing to march on our journey, would fly by us in such vast flocks that they would be near a quarter of an hour before they were all passed by, and as soon as that flock was passed another would come, and so successively one after another for a greater part of the morning. It is observable that wherever these fowls come in such large numbers, as I saw them then, they clear all before them, scarce leaving one acorn upon the ground, which would doubtless be a great prejudice to the planters that would seat there, because their swine would be thereby deprived of the mast. When I saw such flocks of the Pigeons I now speak of, none of our company had any other sort of a shot than that which is cast in moulds and was so very large that we could not put above ten or a dozen of them into our largest pieces. Wherefore we made but an indifferent hand of shooting them; although we commonly killed a Pigeon for every shot. They were very fat and as good Pigeons as ever I eat."

While it can hardly be claimed that the writings of John Lawson are of any great ornithological value, they are at least interesting from a historical standpoint and should most assuredly be included in any bibliographical sketch of North Carolina ornithological study.

The work of Col. Wm. Byrd of Westover, Va., next claims our attention. It was he who conducted the survey of the boundary line between ————, Va., and North Carolina in 1729. The narrative of his experiences which we are told was written largely for his own amusement and that of his friends, contains besides an account of the survey many side remarks on the inhabitants of the territory which he traversed. His references to natural history are not infrequent, but are for the main part of little moment. The following contribution on the habits of the Carolina paroquet, a bird now extinct, may be of interest. "Very few in this country have the industry to plant orchards, which in a dearth of rum might supply them with much better liquor. The truth is there is one inconvenience that easily discourages lazy people

from making this improvement. Very often in autumn when the apples begin to ripen they are visited with numerous flights of paroquets, that bite all the fruit to pieces in a moment for the sake of the kernels. The havoc they make is sometimes so great that sometimes whole orchards are laid waste in spite of all the noises that can be made or mawkins that can be dressed up to frighten them away. These ravenous birds visit North Carolina only during the warm season and so soon as the cold begins to come on retire back towards the sun. They rarely venture so far north as Virginia except in a very hot summer, when they visit the most southern parts of it. They are very beautiful, but like some other pretty creatures are apt to be loud and mischievous." He does not attempt to catalog the birds of the country.

In the library of the State College at Columbia, S. C., I recently found that rare and interesting work of Catesby "The Natural History of Carolina, Florida and the Bahama Islands," published in 1731. A careful reading of its pages, however, reveals the fact that the author in all probability was never within the borders of North Carolina. He went up the Savannah river almost to the mountains and hunted buffalo with the Indians; later he sailed for Virginia, and ascending the James river, traveled thence westward to a point almost north of that reached on his trip from Savannah. There seems to be no evidence that he ever saw the intervening territory. This is to be regretted, as Catesby was not only an artist of merit but for the times must have been a very careful and painstaking naturalist. I mention this work because its title would lead one to think he had made a study of the Natural History of this state.

In my quest for information regarding early ornithological writers I applied to North Carolina's most noted historian of today, Dr. Stephen B. Weeks, and from him received many courtesies including the loan of some of the books from his extensive library. One of these is the work of Dr. John Brickell published in Dublin in 1737, and bearing a comprehensive title as follows: "The Natural History of North Carolina, with an account of the trade, manners, and customs of the Christian and Indian inhabitants; illustrated with copper plates, whereon are curiously engraved the map

of the country, several strange beasts, birds, fishes, snakes, insects, trees and plants, etc."

His list of birds follows closely that of Lawson published some years previously, and the similarity of the text in many instances strongly suggests the idea that he frequently bordered closely on plagiarism.

He enumerates 129 kinds of birds. Five of these at least we must eliminate at the start. He makes three eagles out of one, naming as he does in addition to the bald eagle the black and gray eagles which are simply different phases of the immature bird. We, of course, cannot accept two species of leather-winged bats for birds, and the nightingale which he mentions is not found in a wild state in the Western Hemisphere.

Although Dr. Brickell in his Preface says regarding his Natural History writing "I have been very exact," the reader is not always so impressed. Of the brown pelicans he says "They have an odd kind of note much like the braying of an ass, and in spring they go into the woods to breed and return in the autumn." Whereas it is a well-known fact that the pelican is an absolutely silent bird and breeds on the ocean beaches or on mangrove Keys of the Gulf coast. Of the cuckoo he writes "In winter they hide themselves in hollow trees, and their feathers come off, and they are scabby, they usually lay one egg, and that in the nest of the Hedge Sparrow."

This reminds one of the story of the Naturalist Humbolt to whom a student stated that a lobster was a red fish which runs backwards. Humbolt is reported to have replied "You are right in all but three things, viz: it is not red, it is not a fish and does not run backwards." The Carolina cuckoos do not hide in hollow trees, they do not lose all their feathers at once and become scabby, they lay not one but from two to four eggs in a nest of their own construction, and finally the hedge sparrow is not found in America.

In treating of the gray eagle he discusses at considerable length its interesting characteristics of form and activities. In part he says "They are great thieves, and live to be very old and die not from age nor any sickness, but of mere hunger by reason that the

upper beak of their bill is so far over grown and turneth inward so much, that they are not able to open it to feed themselves. They seldom seek their prey in the forenoon, for they are found sitting idle and perched upon trees all the morning. It is reported that the quills or feathers of eagles laid amongst those of other fowls will rot and consume them, which I have not faith to believe. The flesh though scarce fit to be eaten is medicinal against the gout, the bones of the skull in powder are good against megrim, the brain drank in wine, helps the jaundice, and the gaul is of excellent use in most disorders of the eye, and applied helps the bitings of serpents and scorpions, etc.

Delicious as Brickell's natural history sketches are, it is almost certain that he acquired much of his material from the Indians and settlers and has woven into his narrative many of the traditions and superstitions of the country. Positive statements as to what he actually saw occur but seldom, one of these is when in speaking of the smallness of the hummingbird he remarks "I have frequently seen butterflies chase them away from the flowers." The butterfly of his day must have been a pretty formidable creature.

Another of these early gentlemen who traveled through the South and left his writings for the benefit of posterity was Wm. Bartram in 1791. His book is entitled "Travels through N. C. S. C., Fla., etc." It seems, however, that he made but one hasty trip through North Carolina. He traveled by land. Entering the State in Brunswick county, he proceeded to Southport, passed from there up the Clarendon (or Cape Fear river) to Cambletown (now Fayetteville), and thence on to Virginia. He speaks briefly of the trees, soil and rocks, but makes no reference to the wild animal life. Some of his stories are very lightly colored. He speaks of the alligators of S. C., rushing at him with terrible roarings and with steam rushing from their mouths and nostrils which threw over him a hurricane of water. In reading his writings one is inclined to believe that William Bartram would come under the class of President Roosevelt's "Nature Faikirs."

Apparently the first real ornithologist to visit North Carolina for the purpose of studying the birds was Alexander Wilson, a Scotch-

man who traveled through the country collecting birds and making drawings of them by day and playing the violin for profit or diversion at night. Wilson was a field naturalist of the first order, and his great work "American Ornithology" illustrated in colors with his own most creditable drawings in colors has well won for him the title of "Father of American Ornithology," despite the fact that his work was eclipsed some years later by the stupendous undertaking of Audubon. As an ornithologist Audubon was Wilson's superior only in that he was a more skilful artist. As a man Wilson was of humble parentage, but indifferently educated, was poor, retiring, sensitive and self-effacing. Audubon was of excellent parentage, was highly educated, was always confident and at times self-assertive. Both were great contributors to the world's knowledge of American birds, and it was their work which aroused real interest in the subject and put in motion the movement for bird study from which has since developed a long line of brilliant American naturalists.

On one of Wilson's trips through North Carolina, he found a specimen of the largest of all American wood-peckers, the Ivory-billed. The bird has long been extinct in this State. Another point of interest attending this capture by Wilson is that there is no record of one ever having been taken farther north in Eastern America. His record is therefore interesting and unique. He says, "The first place I observed this bird at, when on my way to the south, was about twelve miles north of Wilmington in North Carolina. There I found the bird from which the drawing of the figure in the plate was taken. This bird was only wounded slightly in the wing, and, on being caught, uttered a loudly reiterated, and most piteous note, exactly resembling the violent crying of a young child; which terrified my horse so, as nearly to have cost me my life. It was distressing to hear it. I carried it with me in the chair, under cover, to Wilmington. In passing through the streets its affecting cries surprised every one within hearing, particularly the females, who hurried to the doors and windows with looks of alarm and anxiety. I drove on, and on arriving at the piazza of the hotel, where I intended to put up, the landlord came forward, and a number of other persons who

happened to be there, all equally alarmed at what they heard; this was greatly increased by my asking, whether he could furnish me with accommodation for myself and my baby. The man looked blank and foolish, while the others stared with still greater astonishment. After diverting myself for a minute or two at their expense, I drew mp woodpecker from under the cover, and a general laugh took place. I took him up stairs and locked him up in my room, while I went to see my horse taken care of. In less than an hour I returned, and, on opening the door, he set up the same distressing shout, which now appeared to proceed from grief that he had been discovered in his attempts to escape. He had mounted along the side of the window, nearly as high as the ceiling, a little below which he had begun to break through. The bed was covered with large pieces of plaster; the lath was exposed for at least fifteen inches square, and a hole, large enough to admit the fist, opened to the weatherboards; so that, in less than another hour he would certainly have succeeded in making his way through. I now tied a string around his leg, and, fastening it to the table, again left him. I wished to preserve his life, and had gone off in search of suitable food for him. As I reascended the stairs, I heard him again hard at work, and on entering had the mortification to perceive that he had almost entirely ruined the mahogany table to which he was fastened, and on which he had wreaked his whole vengeance. While engaged in taking the drawing, he cut me severely in several places, and, on the whole, displayed such a noble and unconquerable spirit, that I was frequently tempted to restore him to his native woods. He lived with me nearly three days, but refused all sustenance, and I witnessed his death with regret." The above account refers to a great woodpecker nearly as large as a crow and now confined to the more inaccessible swamps of the Gulf coast.

What we may term recent ornithological research began in North Carolina in 1871, when Dr. Eliott Coues published in the Proc. Acad. Nat. Sci., Philadelphia, May 2, a series of notes on the birds observed by him while stationed at Fort Macon in Carteret county, 122 species of birds were mentioned.

In 1886, William Brewster of Cambridge spent some time in the

mountains of western North Carolina, and his list of birds published in the "Auk" contains records of 120 species. The preceding winter Charles Bachelder, also of Cambridge, made a number of observations on the winter bird life of the mountains and this likewise was published in the "Auk." One of the discoveries made by Mr. Brewster was the Carolina snow bird (Junco hyemalis Carolinensis). J. S. Cairns, an enthusiastic student of birds living at Waynesville, published the results of his observations in the "Ornithologist & Oologist" in 1887. He enumerates 169 varieties of birds in Buncombe County. It was he who first discovered the Cairns Warbler.

Messrs. H. H. & C. S. Brimley, of Raleigh, were for many years engaged in collecting birds for scientific purposes. During this time and since they have gathered much valuable information on the nesting and migration habits of the birds which occur there. Between 1884 and 1891 they published in the "Ornithologist & Oologist" 76 articles on Raleigh Bird Life. Mr. R. B. McLaughtin during 1887-1888 contributed 9 articles to the same publication on the birds of the Statesville region.

Additional papers on the bird life of the state to the extent of 47 in number by various authors have been published; principally in the "Auk" and the "Ornithologist & Oologist."

Thus briefly and somewhat hastily I have attempted to sketch what has been done in the line of ornithological study in North Carolina. It will be observed that the work done has been mostly in gathering notes on the geographical distribution, migration and modification of the species found in the state. Considerable attention has also been paid to Oology by Messrs. Brimley of Raleigh, McLaughtin of Statesville, Joseph Armfield of Greensboro (whose splendid collection of eggs of our native birds may be seen at the Museum of this College), Dr. Smithwick of Arora and a few others.

Today we know of positive records of 325 species of birds which have been taken in the state, some of these at least are exceedingly rare and may be regarded only as stragglers. Among these may be mentioned the Northern Phalerope taken by Dr. Bishop at Pea Island; the Ruff taken at Raleigh by Mr. Brimley; the

Black-necked Stilt captured at Roanoke Island by the Rev. Mr. Moyle; the bay-breasted Warbler noted at Chapel Hill and the Man-o'-war bird secured at Ocracoke by the speaker.

It may not be out of place here to mention that the state Audubon Society has in preparation a book on the birds of the state and a note regarding any rare finds made by members of the Academy will be greatly appreciated. In conclusion it has occurred to me that it might not be out of place to present to the Academy some views illustrating game preserve activities in the state also showing what the Audubon Society has been able to accomplish in one small island in the way of protecting sea birds.

Greensboro, N. C.

PROCEEDINGS OF THE NORTH CAROLINA ACADEMY OF SCIENCE

The North Carolina Academy of Science held its seventh annual meeting at the State Normal College, Greensboro, N. C., on Friday and Saturday, May 1 and 2, 1908.

The Academy was called to order at 3:30 P. M., May 1, by the president, T. Gilbert Pearson. A letter of welcome to the academy from President J. I. Foust of the College was read. A response to this welcome was made by the retiring president, Collier Cobb, of the Academy.

At 8:30 in the evening the Academy met in the auditorium of the Students' Building, and the presidential address, "An Historical Sketch of Ornithology in North Carolina" (illustrated by lantern slides)* was delivered by President T. Gilbert Pearson. Following this address a reception was tendered the members of the Academy by the faculty and students of the senior and junior classes of the College in the dining room of Spencer Building. Later President and Mrs. Pearson received the visiting members at their home on West Market Street.

At 9 A. M. Saturday, May 2, the Academy convened for a business meeting. Reports of various committees were heard. The report of the treasurer showed a balance of $119.60.

The following new members were elected: Mr. Harry N. Eaton, Instructor in Geology, and Mr. Hubert Hill, Assistant in Geology, University of N. C.; Mr. R. I. Smith, Entomologist to the N. C. Experiment Station, West Raleigh; Mr. S. B. Shaw, Assistant Horticulturist N. C. Department of Agriculture; Dr. L. L. Hendron, Professor of Applied Mathematics, Trinity College, Durham, N. C.; John Roy Williams, M.D., Greensboro; Mrs. Charles D. McIver, State Normal College, Greensboro.

*This address appears in full in this issue of the Journal.

The following officers were chosen for the ensuing year:

President, Tait Butler, Department of Agriculture, Raleigh.

Vice-President, J. J. Wolfe, Trinity College, Durham.

Secretary-Treasurer, E. W. Gudger, State Normal College, Greensboro.

Executive Committee, Chas. H. Herty, University of N. C., Chapel Hill; John F. Lanneau, Wake Forest College, Wake Forest; W. H. Pegram, Trinity College, Durham.

The Committee on Resolutions brought in the following report, which was unanimously adopted:

> In pursuance of the duties devolving upon the committee appointed, the committee begs to submit the following resolutions:
>
> (1) That in the death of Prof. J. W. Gore, Dean of the Department of Applied Science and Professor of Physics at the University of North Carolina, the North Carolina Academy of Science feels that it has suffered profound loss,—the loss of an investigator whose scientific attainments were notable, a scholar whose interest in scientific progress, in general as well as in his own and allied subjects, was unbounded, and a man whose broad humanity and high Christian character were a source of inspiration to all with whom he came in contact.
>
> (2) That a copy of these resolutions be published in the official organ of the Academy and likewise in the public press.

The next meeting of the Academy will be held at Trinity College, Durham, N. C., May, 1909.

The following papers were presented:

The Amanitas of the Asheville Plateau, by H. C. Beardslee, of Asheville, N. C.

The following list of species was reported:

Amanita Caesarea Scop., A. virosa, A. Phalloides Fr., A. muscaria Linn., A. pantherina DC., A. junquillea Quel., A. strobiliformis Paul., A. solitaria Bul., A. schinocephala Vitt., A. rubes-

cens, A. cinerea Bres., A. nitida Fr., A. vaginata Fr., A. volvata Pk., A. farinosa Schw., A. mappa Fr.

The species A. verna, virosa, and phalloides were considered as not distinct.

Amanita junquillea Quel. was illustrated by photographs and specimens and compared with the European forms. The American A. russuloides Pk. was referred here, also the European species A. amici, adnata, and vernalis. Photographs and specimens had been seen by Bresadola and Boudier who verify this conclusion. Specimens of the European form had also been examined.

Amanita cinerea Bres. was shown to include A. spreta Pk.

A. volvata was shown to be the plant referred by Quelet and Bataille to A. coccola Scop. It was also considered the true A. agglutinata of Curtis, and A. baccata as understood by Bresadola.

Photographs of many forms of A. sŏlitaria and its allies were shown illustrating the difficulty of successfully defining species in this much confused group.

Distribution and Migration of Warblers at Raleigh. C. S. Brimley of Raleigh, N. C.

An Adjustable Armellary Sphere—Newly Designed, J. F. Lanneau, of Wake Forest College, N. C.

This paper dealt with a unique piece of apparatus—a light, symmetrical mechanism, built by Wm. Gaertner & Co., Chicago, after Professor Lanneau's design—for class-room use in Wake Forest College.

Its special feature is the placing of the horizon plane and vertical circles *within* the celestial circles, and the two concentric systems, mechanically *independent*, allowing of the real eastward rotation of the former, or of the apparent westward rotation of the latter.

SOME ILLUSTRATIONS.

1. An alluminum ball at the centre represents the sun; and by a simple device a smaller ball revolves around it eastward in the plane of the ecliptic, representing the earth's annual motion.

2. With central ball representing the earth, to it is securely attached the horizon plane and vertical circles for, say, an observer in latitude 36° north. Clamping the celestial circles in fixed position, the earth-ball with its horizon system is easily rotated eastward, showing sun-rise and sun-set and the rising and setting of moon, stars and planets—these objects being suitably indicated, for any given date, in their apparent places on the celestial frame-works. Or clamping the horizon in its seemingly fixed position, the celestial circles and objects in place are readily rotated westward in accord with familiar appearances.

3. Altering in latitude the attachment of the horizon plane to the earth-ball, the apparatus shows in turn the reality and the appearances to an observer at the equator; or, again, to an observer at the north pole during his six-months' day and his six-months' night.

4. Some circles and the celestial objects may be variously adjusted and placed for an indefinite number of of astronomical illustrations.

5. Selected circles and objects may be duly disposed to facilitate apprehension and solution of numerous celestial problems—and, if problems also in geodesy and navigation which involve the ever-recurring "astronomical triangle".

QUESTION AND ANSWER.

Are the earth and sun at the centre? They are not held to be at the centre of the myriad stars of the visible universe. They are at the centre of the "celestial sphere", conceived of as everywhere equidistant from the earth; so distant as to be beyond the remotest star. Its quasi reality is that vast shell of void space beyond the stars, upon which as a dark, spherical background all the stars appear fixed as viewed from the central earth. So measureless its remoteness, any point within the earth's comparatively little orbit, including the sun, is virtually its centre.

This "celestial sphere", with sun or earth as centre, is the basis of practical astronomy. Its standard circles in miniature are part of our armillary sphere.

Concerning Sclerotinose of Lettuce, F. L. Stevens and J. G. Hall, of the N. C. Experiment Station, Raleigh.

The term *Sclerotinose* was proposed as a designation for diseases caused by *Sclerotinia*, and Sclerotinose of lettuce was characterized as one form of lettuce drop caused by *S. Libertiana*.

As the result of two years' study the authors conclude that the only part of the fungus that lives through the quiescent period of the disease is the sclerotium and that each season's infection is by wind borne ascospores produced from these sclerotia. They recommend that the formation of sclerotia be prevented by early removal and destruction (incineration or burial) of infected plants. This course followed for a few years, accompanied by the exhaustion of all sclerotia originally in the soils by germination, seems promising as a means of ridding infected regions of the pest.

The Origin of Certain Topographic Features along the Sand-Hills Border of the Atlantic Coastal Plain. Collier Cobb, of the University of North Carolina.

Notes on the Life-zones in North Carolina.* By C. S. Brimley and Franklin Sherman, Jr., Raleigh, N. C.

The authors, having made a careful detailed study of all available records of the occurrence and distribution of animals in the state, present their conclusions as to the probable boundaries of the different life-zones. The groups of animals chiefly relied upon are: Mammals, Reptiles, and Batrachians. Birds and insects have been used mainly to confirm ideas otherwise originated.

It is found that four distinct life-zones are represented in the state as follows:

1. *The Canadian Zone*, including only the tops of the higher mountains, usually above 4,500 feet elevation. The following places are placed in this zone: Black Mountains, Roan Mountain, Grandfather Mountain, Bald Mountain in Yancey County, and the higher mountains in Macon County near Highlands.

*This paper was published in full in this Journal, for May, 1908.

2. *The Alleghanian Zone*, includes practically all between the elevation of 2,500 ft. and 4,500 ft. This includes most of the Blue Ridge and Smoky Mountains, Nantahala Mountains, Balsam, Pisgah Ridge and the lower elevations of Black Mountains and others mentioned as belonging to the Canadian zone.

3. *The Upper Austral Zone* includes all of the state north and west of a line drawn from Suffolk, Va. to Raleigh, thence to Charlotte, thence to the South Carolina line near Tryon in Polk County—except that portion already assigned to the Canadian and Alleghanian zones.

4. *The Lower Austral Zone* includes all of the state to the south and east of the line just mentioned.

Lists are given of the characteristic animals in each of these zones, and mention is made of a number of exceptional records, where animals have been taken beyond the limits of what their range would supposedly be.

The counties in the extreme northwest part of the state have not yet been zoologically explored, and are therefore not yet assigned to any zone, awaiting the accumulation of more records.

The Relation of Bovine Tuberculosis to the Public Health. Tait Butler of the Dept. of Agriculture, Raleigh.

"*The Twenty-Seven Lines Upon a Cubic Surface.*" Archibald Henderson of the University of North Carolina.

In his paper, Dr. Henderson explained that by the selection of a highly symmetrical equation of a cubic surface:

$$\left(\frac{x}{x_2}+\frac{y}{y_2}+\frac{z}{z_2}+\frac{w}{w_2}\right)\left(\frac{xz}{x_1z_1}-\frac{yw}{y_1w_1}\right)$$
$$-\left(\frac{x}{x_1}+\frac{y}{y_1}+\frac{z}{z_1}+\frac{w}{w_1}\right)\left(\frac{xz}{x_2z_2}-\frac{yw}{y_2w_2}\right)=0$$

by a proper choice of constants x_1, y_1, z_1, w_1; x_2, y_2, z_2, w_2; and finally by employing a regular tetrahedron of reference, that it was not difficult to derive very simple and symmetrical equations of the twenty-seven lines upon the cubic surface, and therefore to

construct a string model of the configuration, showing the fundamental tetrahedron and the twenty-seven lines in proper relation to each other and to the fundamental tetrahedron. Instead of a string or wire model, he exhibited a beautiful perspective drawing in colors, of the configuration.

The Scope and Function of Science. Wm. Louis Poteat of Wake Forest College. [Read by title.]

Some Trials of a Museum Curator. H. H. Brimley, State Museum, Raleigh. [Read by title.]

The Oral Gestation of the Gaff Topsail Catfish, Felichthys marinus. E. W. Gudger of the State Normal and Industrial College.

This paper was given by permission of the Commissioner of Fisheries and will later be published in the Bulletin of the Bureau.

The Proximate Constituents of the Oleoresins of Pinus palustris and Pinus heterophylla. Chas. H. Herty of the University of North Carolina.

*The San José Scale.** By Franklin Sherman, Jr., Entomologist N. C. Dept. Agriculture, Raleigh.

The paper opens with an apology and explanation for presenting a paper upon so threadbare a subject before the Academy, — stating however, the author's belief that popular presentation of subjects of economic interest to the state should have a conspicuous place on the program.

A brief account of the history and general distribution of the San José Scale (Aspidiotus perniciosus, Comst.) is given, and mention is made of the principal food-plants, and methods of spread.

Referring to conditions within the state of North Carolina it is shown that present records indicate the pest in 65 counties, at 145 different post-office localities and on at least 423 different premises. It is a *safe presumption* that it is in many localities in addition to those on record. It is a *reasonable presumption* that it is

*This paper appears in full in this issue of the Journal.

in every county in the state but it *cannot be presumed* that it is in every locality, — and there is every reason to believe that many individual premises are not yet infested by it.

In at least seventeen communities it is generally distributed, having been found in a number of orchards or perhaps in all. In the west, it is known in the counties of Cherokee, Haywood, Mitchell and Watauga, — and in the east in the counties of Brunswick, New Hanover, Carteret and Pasquotank. It is found only a few feet above sea-level, and at an elevation of 4,000 ft.

According to present records the worst-infested counties are as follows in order of infestation: Catawba, Surry, Guilford, Moore, Gaston, Wake and Polk.

Concerning the Difference of Behavior of Soil Organisms When in Solution and When in Soils. F. L. Stevens and W. A. Withers of the N. C. Experiment Station, Raleigh.

(A prelimiminary Report of work done by F. L. Stevens and W. A. Withers assisted by W. A. Syme and J. C. Temple.)

Results of numerous experiments were adduced to show that the activities of ammonifying, nitrifying, denitrifying and nitrogen gathering bacteria are different in soils from what they are in solutions and that no adequate knowledge of the efficiency of these various soil organisms in effecting chemical change can be attained by tests conducted in solutions. Even the relative powers of different organisms or of different soils is largely affected by the conditions of the test. It seems therefore that in the study of soil bacteria the work must be done with soils, rather than with solutions or at least that frequent controls or checks in soil must be made.

THE SAN JOSÉ SCALE

A Brief Popular Account of a Notorious Insect Pest, with a Statement of its Present Recorded Status in North Carolina*

BY FRANKLIN SHERMAN, JR.

About three years ago, two prominent amateur collectors of insects, each an authority in his chosen group, were in this state on a brief collecting trip, and, by arrangement, I met them and spent a day in their company. It chanced that the orchards throughout all that neighborhood (Southern Pines) are infested with the San José Scale, and when I mentioned this fact quite incidently, both immediately expressed great interest and desire to see the pest, saying that they had often heard of it but had never seen it or received any first-hand information concerning it. Yet this insect is so notorious a pest, that among economic entomologists the discussion of it is now almost debarred, by mutual consent and unwritten law, from the public meetings. One year ago, at the sixth annual meeting of our Academy at Chapel Hill, Dr. Butler gave a discussion of the Cattle Tick, a pest of wide distribution and of tremendous economic importance to the live-stock interests of the southern states, and while none of the facts which he gave could in any wise be regarded as new and original contributions to science, yet the paper was received with manifest interest by our Academy.

These facts have convinced me that however desirable it may be to present at our meetings the results of really new and original

*Read before the North Carolina Academy of Science, May 2, 1908.

research, one of our most beneficent functions will be missed if we fail at the same time to have on our programs a certain number of popular discussions of matters of economic importance to our state.

So much by way of apology for discussing before this body a subject which to economic entomologists at least, has become threadbare and almost barren of new thoughts.

* * *

The *San José Scale* (Aspidiotus perniciosus) was first described to science in 1880 by Prof. J. H. Comstock, who found it very destructive in deciduous fruit orchards in the Santa Clara valley of California. He recognized it as one of the so-called "Scale-insects", belonging to the genus *Aspidiotus*, remarking that it was the most pernicious scale-insect known to him, and therefore applying to it the specific name of *perniciosus*, and proposed that it be called the Perniciosus Scale. But as the city of San José is not distant from the place where it was discovered it became known by the popular designation of The San José Scale.

There is reason to believe that it became established in California as early as 1870, and there is reason also to believe that it was introduced into California from China, which seems to have been its original home.

In the eastern United States the insect was not known until 1893 (only fifteen years ago) when it was discovered at Charlottesville, Va. on trees which had been purchased from New Jersey nurseries and these nurseries had presumably become infested by the importation of stock from California. Only four or five years later it was known to exist in twenty states east of the Mississippi river. It is not to be supposed that Charlottesville, and the New Jersey nurseries, were the only sources of scale in the east. It is likely that it became established in many other localities and perhaps in other nurseries at about the same time.

So far as we know the San José Scale gained its first foot-hold in North Carolina at or near Southern Pines, Moore County, about 1893 or 1894, approximately at the same time that it was discovered at Charlottesville. It was not recognized until 1895 at

which time it had gained a strong foothold. In 1897 it was known in six or eight localities, In 1900 it was known in about twenty places. In August 1904, it was known in 44 counties. At present (April 1908) it is known to be on no less than 423 different premises, at 145 different post offices (or rural routes therefrom), in 65 counties. Further details of its present known distribution in this state will be discussed later.

Trees that are very badly infested with the San José Scale look as if they had been dusted over with ashes. Examined with a lens this scurfy crust on the branches is found to be made up of hundreds of little nipple-like objects or scales, lying close to the bark. The largest scales are those of the mature females and are gray in color, circular, about the size of the head of a good-sized pin but with a slightly greater degree of convexity than the surface of the top of the pin-head. Slightly to one side of the center of the scale is a lemon-yellow nipple or "center". Turning over this scale with a pin or knife-point we may find the bright yellow, soft-bodied, wingless, eyeless, legless body of the female insect beneath. Indeed, her energies seem concentrated on the two all-important biological functions of assimilating food and reproduction. The food is procured by means of a slender thread-like organ thrust into the bark and through which the sap of the tree is imbibed.

The young are born alive, there being no distinct egg-stage in the life-history of the species, and the young are able to creep out from under the parent scale. For a few hours these yellowish young lice, barely visible to the naked eye, are able to creep about freely, but when they are compelled by hunger to thrust their beaks into the bark to draw nourishment they become permanently attached, and after a few hours more the scale begins to form, being composed of a waxy secretion from the body, combined with the cast skins of the growing young insect.

There are a number of complete and distinct generations of the insect in the course of the season, but when settled cold winter weather comes the old insects nearly always die, leaving only the partly-grown ones to survive. These over-wintering scales are almost black and about as large as the cross-section of the body of

a good-sized ordinary pin. When the growing season opens in the following spring the female develops as already described while the scale of the male becomes elongate and the creature finally develops into a tiny yellowish, winged, flying insect, which although mouthless and thus incapable of taking sap from the tree, is endowed with an extra set of eyes to make all the more certain of finding mates and providing for the perpetuation of his species.

We have said that the scales may be matted together in a scurfy coating over twigs and branches of badly-infested trees. In cases of slight infestation the scales may be scattering, only a few being found on a piece of twig, or perhaps even only one or two being found on an entire tree. Where the scales are scattering on the bark each scale is apt to be (but is not always) surrounded by a reddish blotch or spot. This reddish staining is very noticeable in the inner bark of badly infested twigs. It is also quite conspicuous on those varieties of trees which have a yellowish or greenish bark, in contrast to which the reddish blotches show up in bold relief.

We have stated that the insect after once settling down to feed remains attached at that spot. We have also seen that the female never emerges from under the shell or scale. The adult male, which can fly, can play but an unimportant part in the spread of the species. How, then is the species distributed? The several agencies by which this is accomplished are:—1st, by its own natural powers, each young louse often crawling several inches from the parent scale before attaching itself, 2nd, by wind, which in blowing through an orchard may waft the tiny young like particles of dust or pollen from one tree to another, 3rd, by birds, which may alight in an infested tree and then rapidly transport young crawling lice on their feet or feathers to new trees, 4th, by insects, in same way as by birds, 5th, by man, horses, etc. in cultivating or working in the orchard and passing from tree to tree. All the above means facilitate its spread locally from tree to tree, or from one orchard to another in the same neighborhood. But for spread into new and distant localities the San José Scale is chiefly dependent on still another method, namely 6th,

the transportation of infested trees or plants. It is on account of this last feature of its spread that all of the eastern states have adopted measures providing for the the inspection of fruit-tree nurseries and the condemnation of stock found to be infested.

The San José Scale is not capable of living and thriving on all kinds of plants. For convenience its food-plants may be divided into three clases. First, the *ordinary food plants* on which it is most commonly found, and including peach, apple, plum, pear, cherry, and apricot. Second, the *not uncommon* food plants, including currant, gooseberry, rose, grape, osage-orange, thorn-apple, Japan walnut, Japanese (or flowering) quince, poplar, elm, and linden. Third, what we may call *the uncommon or rare food-plants* including persimmons, walnut, sumac, catalpa, willow, ash, dogwood, maple, spruce, cedar, raspberry, strawberry, milkweed, and even crabgrass.

In short, while it is found on a great variety, yet its economic aspect is principally concerned with its occurrence on our cultivated deciduous fruit plants, (especially orchard trees) and such ornamental plants as belong to the botanical family Rosaceae. Only in rare cases has it been found in the actual forest and the forests are not appreciable factors in harboring or disseminating it.

The length of time that a tree will live after it becomes infested depends upon the hardiness of the tree and the age at which it becomes infested. With peaches from two to six years (depending on age) will usually be fatal, while for apples from two to ten years is required to kill, or perhaps they may not entirely die at all from the scale.

There are certain natural enemies which have a tendency to reduce the numbers of the scale, or at least to prevent its becoming so abundant as it otherwise might. Several species of internal insects parasites infest it, while more than one of our native lady-beetles devour it. A fungous disease also does some good work, while only in recent years the U. S. Department of Agriculture introduced a Chinese species of lady-beetle for which great things were hoped but which has been unequal to the emergency.

For nearly ten years after this pest was discovered in the eastern states fruit-growers relied upon emulsions of kerosene or

solutions of soaps to subdue it, and the more skillful, careful and resourceful growers were enabled to keep their orchards profitable, even though badly infested. During 1901 and 1902 experiments were made which demonstrated that the lime-sulphur-salt wash, long in use on the Pacific coast, was useful here also and it quickly came into general use. Within another two years it was clearly demonstrated that the salt was not of material value in the mixture. The mixture as now most widely used in this state consists of 20 pounds lime and 17 pounds sulphur, boiled an hour, to 50 gallons of water, the wash being sprayed on the trees while still hot or warm. This remedy not only holds the scale in practical control, but also retards other insects to some extent, and is also claimed to be quite an effectual preventative of leaf-curl of peaches. Certainly it is efficacious in removing much moss, lichens and loose dead bark from trunk and branches and it seems to promote a healthy growth of new wood and bark. Indeed, so marked have been the benefits from this wash that many thoughtful, sensible fruit-growers declare that, all things considered, the appearance of the San José Scale in their orchards has worked to their ultimate advantage rather than otherwise. Certainly the appearance and spread of the pest has caused our fruit-growers to awaken to the importance of other insects also, as nothing else had done before,—and the science of Economic Entomology has gained a decided impetus from it.

* * *

Referring again to the present known conditions with regard to the San Jose Scale in this state,—it has been my frequent experience to be asked by really intelligent and apparently otherwise well-informed men, whether this pest is actually known to occur within the borders of North Carolina. In order that at least every person here present may be assured in the affirmative on this point I present herewith a map of the state on which each locality where the scale is known to exist, no matter how slightly, is marked with a black dot. The numbers refer to the number of different premises actually known to be infested in the county. Localities which seem to be generally infested

with the San José Scale (the pest presumably being present in all or most of the orchards) are marked with black circles or ellipses, etc. as the case may require to denote the infested territory. It must be remembered that this records the present conditions only so far as known to us, and our knowledge is probably far from complete.

Without going into a detailed consideration of each county a few general considerations may be of interest. The map shows the scale recorded in 65 of the 98 counties in the state. It shows145 different localities infested (and really there are more as a locality as here designated includes all who are served by the rural mail routes from that point) and the complete list numbers 423 separate premises. In 17 communities the scale is generally distributed. We find that it is in the counties of Cherokee, Haywood, Mitchell and Watauga bordering the Tennessee line, and in the east it is found in the counties of Brunswick, New Hanover, Carteret and Pasquotank. With regard to elevation, it occurs at sea-level in Brunswick and but little higher in Carteret, Beaufort and Pasquotank, yet it is also found at 3,000 ft. elevation in Haywood and at about 4,000 ft. in Watauga. The area of heaviest infestation seems to be the piedmont, but the fact that this is the most thickly settled region, has been more frequently visited and inspected, and that we have more correspondence among farmers in this section than others explains this condition to some extent. The records of one case each in the counties of Craven, Beaufort and Pasquotank are due to the activity of Prof R. I. Smith, Entomologist of the Experiment Station who discovered these cases while on a recent Farmers' Institute tour through this section,—and they go to show that the scale is far more widespread than our records yet indicate.

We know therefore that the San José Scale is already wide spread in the state. It is a *safe presumption* that it is in many localities in addition to those on record. It is a *reasonable presumtion* that it is in every county in the state, though we connot yet rightfully presume that it is present in every locality, and there is every reason to suppose that there are many individual orchards which are yet free from its attacks. But it is plainly evident that

no section of the state is immune, and no man can safely presume that his neighborhood is free from it. It is firmly established as a permanent pest to be taken into consideration from the outset be every person who enters the fruit growing business.

It is difficult to say which county is the worst infested. Based solely on the number of infested premises on record Catawba county leads with 62 cases, Guilford second with 32, and Gaston a close third with 31. Based on the number of localities where scale is known to exist Surry leads with 9 localities, Guilford second with 7, while Moore and Gaston tie for third place with 6 infested localities each. The following table briefly indicates the recorded conditions for each county which is known to have 5 or more localities in which there is San José Scale.

County	No. Localities Infested	No. Premises Infested	Average Premises per locality.
Catawba	5	62	12 2-5
Surry	9	27	3
Guilford	7	32	4 4-7
Moore	6	28	4
Gaston	6	31	5 1-6
Wake	5	21	4 1-5
Polk	5	16	3 1-5

In conclusion it should be repeated that all the statements as to the present conditions in this state are based solely on the *present available records*. New cases are still coming to light almost every week.

Raleigh, N. C.